

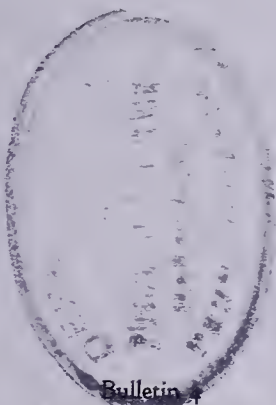
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COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF PUBLIC INSTRUCTION

INDUSTRIAL ARTS EDUCATION  
IN  
GRADES 7-8-9



(REVISED REPRINT)



Harrisburg, Pennsylvania  
1927

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DEPARTMENT OF PUBLIC INSTRUCTION

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Bulletin 4  
Harrisburg, Pennsylvania  
1927

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF PUBLIC INSTRUCTION  
Harrisburg

Superintendent of Public Instruction  
JOHN A. H. KEITH

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## FOREWORD

The seventh, eighth and ninth school years should be particularly significant. Pupils in these years are conscientiously striving to find out upon what kind of a life career they should embark. It is now recognized as essential that boys in these years should have, among other things, instruction that will assist them in determining vocational interests and capacities. They should have instruction in the industrial arts—not with a view of developing vocational competence, but in order to provide try-out and exploratory opportunities, and to give a broad, appreciative understanding of tools, materials, processes and design as they are involved in the industrial arts. The shop instruction should be coupled with information about the lives of the people concerned, and with a wealth of other related information that is truly educational.

Emphasis in this bulletin has been placed on the general shop since industrial arts instruction of the type contemplated cannot well be given in the smaller communities in any other way. In the larger school districts separate shops for woodwork, machine work, printing, electricity, drawing, etc., can be maintained; but this is not true of the less populous districts; hence, the general shop, or a modification of the general shop, appears to be the best solution in school districts not large enough to maintain separate or unit shops in the various types of work mentioned.

This bulletin was prepared by Mr. Gerald D. Whitney, formerly of this Department, under the direction of Deputy Superintendent of Public Instruction L. H. Dennis. Revisions have been made by Mr. P. L. Cressman, Assistant Director of Vocational Education and his Associates, Mr. C. E. Hedden and Mr. J. J. Matthews, Supervisors of Industrial Education in the Vocational Division.

JOHN A. H. KEITH,

Superintendent of Public Instruction

December 1927

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## I. GENERAL STATEMENT

- A. *Shop Work Principle Well Established.* Shop work in the public schools has become so universally accepted in principle and practice that scarcely a school district of any considerable size can be found in the Commonwealth that does not offer it in some form or other to boys of junior high school age.
- B. *Motives for Favoring Shop Work.* School administrators have favored shop work from a variety of motives. If, for example, a superintendent or principal found a group of boys in school who were likely to leave and go into industry at an early age, he frequently attempted to give them some special instruction that would better fit them for entrance into a skilled trade. If, on the other hand, there did not seem to be such a group in the school he perhaps recognized a need for shop work of a general developmental nature, and devised a course such as has usually been considered of the cultural sort. More recently the junior high school advocates have demanded shop try-out opportunities for all of the boys in the seventh, eighth and ninth school years.
- C. *Wood Shop Best Known Type.* Of the various school shops to be found at the present time, those offering woodwork under the name of manual training are the best known. Such shops have made valuable contributions to education and until recently woodworking has been thought to be in itself an adequate means of realizing the general educational objectives of shop instruction. In the light of present-day thought and experience, however, it is believed that a wider differentiation of shop experience is not only of greater initial interest and appeal to boys but that it has broader implications in general education.
- D. *Several Kinds of Work in One Shop.* Several kinds of industrial arts shop work can be taught in one shop by one instructor just as efficiently as one kind. The main requirement is that the teacher, if he be a wood shop or other shop specialist, shall be capable of adjusting himself to the new conditions imposed by a general shop.
- E. *Shop Work Classified.* At the present time there is a reasonably clear differentiation between the pupil who takes instruction

in industrial arts for the purpose of furthering his general education and the student specializing in a vocational pursuit. Shop and related work of an industrial nature is classified as *vocational* if it is given in accordance with the State Vocational Education Laws which embody the provisions of the Federal Smith-Hughes Act. All other shop and related work (including manual training, manual arts, mechanic arts and prevocational manual training, manual arts, mechanic arts and prevocational shop work) is regarded as *industrial arts* for purposes of classification.

F. *Factors in Selecting Shop Installations.* The demand for shops in any situation can be met intelligently only after an examination of those factors that should always determine appropriate instruction.

1. A careful study of the pupils to be served is essential in determining what kinds of shop instruction are likely to prove most timely and effective.
2. The making of an industrial survey will furnish much enlightenment concerning the nature of local industrial developments. This is important since any public school course involving a study of materials, processes, products and things significant to society should first be based upon the life of the particular community as regards these things.

G. *Installation in Large Junior High Schools.* In a large junior high school where it is possible to provide for group needs and give instruction best suited to the many groups within the school, there should be invariably courses in industrial arts, of either the general shop, the specializing shop type or both. The number of shops will depend upon the number and kind of classes. If besides industrial arts, there is specializing work of the Smith-Hughes type, the equipment for such specialized courses would need to be more specific in character than for industrial arts work where the motive is general development and not intensive specialization.

H. *Installation in Small Junior High Schools.* In a small school, the pupil needs may indicate a scattered demand ranging from specific vocational work to a minimum of industrial arts instruction. For these small districts, it is recommended that the possibilities of part-time co-operative industrial work be canvassed for those boys with a vocational training objective, and that shop instruction in school be centered in industrial arts work in a general shop. The diversified kinds of work

in this shop will provide tryout advantages not to be had in the manual training type of wood shop.

- I. *Handwork for the Mentally Defective Boy.* In dealing with the mentally defective boy in school, it is well established practice to stress handwork instruction in such processes as he is able to grasp. Industrial arts work can be utilized in the instruction of such pupils but special classes should invariably be organized to handle this special problem.

## II. TERMINOLOGY

The terms used in this bulletin are defined in the following glossary:

1. *PRACTICAL ARTS* education includes such objects as industrial arts, manual training, manual arts, sloyd, household arts, gardening, agricultural junior projects, and phases of commercial education given as a part of general education with no particular vocational objective.
2. *INDUSTRIAL ARTS EDUCATION* includes that part of the practical arts field that pertains to instruction based upon practice with and knowledge about tools, materials, and processes significant to industry.
3. *THE GENERAL SHOP* is a form of industrial arts organization which includes a number of kinds of occupational activities, usually in the same room and under one teacher. It is designated to further the aims of industrial arts instruction more completely than its predecessor, the manual training wood shop.
4. *PREVOCATIONAL SHOP WORK* consists of a variety of shop experiences which are undertaken to provide pupils with a better understanding of their own potentialities as bearing upon their life work. There is no direct attempt to teach a vocation through the instruction given. The underlying thought is to provide pupils with experiences which will enable them to know something of certain representative occupations, and which will assist them to choose wisely for their own future vocations.
5. *INDUSTRIAL EDUCATION* is that form of vocational education which is designed to teach some industrial occupation or trade either in its entirety or in part.



6. *VOCATIONAL GUIDANCE* may be defined as having to do with those activities that assist individuals in choosing, preparing for, entering upon, and making progress in occupations.
7. *THE GENERAL INDUSTRIAL SCHOOL* is a type of vocational industrial organization, distinguished from the unit trade school by the fact that trade groups are offered, whereas unit trade instruction is limited to one occupation. The general industrial school being a form of vocational training, provides that half of a pupil's time shall be spent in actual shop work. In contrast to this, the general shop is not vocational but rather a form of industrial arts with strong prevocational proclivities.

### III. EVENING CLASSES

- A. *Evening Classes Provided by Law.* Evening classes in subjects such as shop work and drawing are provided for in Sections 1901 and 1902 of the School Law.
- B. *Subjects and Conditions.* Evening industrial courses are in operation in many communities in such subjects as shop mathematics, blueprint reading, shop practice and various kinds of mechanical drawing. When the members of a class take this instruction supplementary to their daily employment, State and Federal vocational funds may be used to pay part of the cost of the teachers' salaries for approved trade extension classes. Application for approval to operate Federal and State aided vocational industrial classes must be filed with the Superintendent of Public Instruction.
- C. *Restrictions and Aid.* Classes not restricted to workers in any given occupations, may be conducted as local boards may provide, within the limitations of the school law. These classes are not subsidized from the special funds provided for vocational industrial classes.
- D. *Industrial Arts Evening Classes a Part of General Education.* Industrial arts classes conducted in the evening are essentially a part of general education and as such fill a definite need in the lives of a number of people, young and old, who wish to get shop experiences in this type of class. Such classes are very valuable in social centers, especially in the congested quarters of the larger cities.

#### IV. AIMS OF INDUSTRIAL ARTS INSTRUCTION

- A. *Popular Appeal in Lieu of Definite Aims.* Aims for shop courses have been stated in a great variety of ways. It has seemed at times that whereas nearly every one has been willing to accept the principle of shop work in schools because of its popular appeal, there has been little unanimity concerning aims resident in such courses.
- B. *Aims Stated.* In 1916 the committee on education of the National Education Association formulated four aims for industrial arts education which may be accepted for the purposes of this bulletin and which have been amplified to show through what medium they may be realized.
1. Worthy aims of instruction in industrial arts subjects may well be:
    - a. To increase the general intelligence of the pupil.
    - b. To stimulate the pupil's powers of wise utilization.
    - c. To help the pupil lay the foundations of vocational choice.
    - d. To assist the pupil to a proper interpretation of contemporary life.
  2. As they stand these aims embrace all of general education. It is only when qualifying means of attainment are stated that the aims become peculiar to the field of industrial arts instruction.
  3. The four aims as stated may be realized through a study of, and participation involving, tools, material, processes and products that are significant to society, and through observation and study about the world's industrial, agricultural, commercial and home-making activities.
- C. *Aims Appropriate for all School Years.* The aims as stated are appropriate for all of the school years, whether the work is taught by the elementary classroom teacher or by the special shop teacher. They apply with special force to grades seven, eight and nine as provided for in this bulletin.
- D. *Skill Not a First Requisite.* Skill, as such, is not mentioned in the statement of aims, since the acquiring of it is not a first requisite in the study of industrial arts. It will invariably follow, however, that varying degrees of proficiency with tools will accompany any considerable instruction and repetition in their use.



- E. *Realization of Aims in Smaller Schools.* The smaller schools need not be handicapped in the realization of the aims for industrial arts. The general shop may be employed to furnish the occupational variety that a larger school unit secures by means of its opportunity of having several different kinds of shops.

## V. SCOPE OF INDUSTRIAL ARTS INSTRUCTION

- A. *In the elementary grades* each classroom teacher should have been trained to instruct in industrial arts work. Such instruction should permeate the content of all subjects, adding a desirable equality to instruction by infusion of industrial arts values. Instruction in the shop may begin with the sixth grade but is often deferred until the seventh.

- B. *In the junior high school years*

In grades seven, eight and nine, special shops should be provided for industrial arts instruction. The material in this bulletin is concerned with the work in these grades.

- C. *In the senior high school years*

In the tenth, eleventh and twelfth years instruction in industrial arts should be optional and ordinarily few should take the work on such a basis.

Note: If a boy desires an industrial course in the senior high schools, it should usually be of the trade type as described in the State plans for vocational, industrial education.

- D. *Scope detailed for junior high school years*

In the seventh, eighth and ninth school years, industrial arts instruction includes shop work, mechanical drawing and work correlated with the other school subjects.

1. The wood shop of a type usually called manual training may be utilized for instruction in industrial arts. It seems probable, however, that the scope of such shops will gradually be enlarged to include some instruction in concrete, electricity, metal work and other significant industries.

If an industrial arts shop is considered as a laboratory in which the boy may grapple with problems requiring the forge, the iron lathe, the soldering iron, as well as

woodworking and electric wiring, it will immediately appear that the traditional manual training shop equipment is inadequate to meet the needs of a course built around the processes mentioned. It is, therefore, recommended that existing manual training wood shops be broadened in scope to include other activities such as are hereafter noted under units of equipment.

2. The specializing type of wood shop may be installed as one of several unit shops devoted respectively to wood, metal, electricity, printing or others of similar bearing on local needs. This wood shop partakes of the nature of cabinetmaking and usually turns out more productive work than would be undertaken in the traditional manual training type of wood shop.
3. Other unit shops, similar to the specializing wood shop just noted, may be installed with profit in schools requiring several shops. Among these the more usual are devoted to machine work, sheet metal, electric wiring, auto repair, printing and painting and decorating.
4. In small schools, requiring but one shop, the type of equipment that gives the largest return in terms of the aims for industrial arts instruction is the general shop. An indication that school authorities have begun to accept this as being true, is demonstrated by the amount of prominence given to the general shop in educational magazines, state departments of education, colleges for the training of teachers and in school districts which are changing their shops to conform with this idea.

E. *Schedule of shops in different-sized districts.*

A schedule of shops which will be needed for junior high schools of varying sizes is here suggested.

1. *For schools containing 100 to 200 boys.*

Option No. 1.

- 1 General shop
- 1 Drafting room (Classroom will do.)

Option No. 2

- 1 Large room containing both.

2. *For schools containing 200 to 400 boys.*

Option No. 1.

- 1 General shop (containing wood and electrical work)
- 1 General shop (containing machine and sheet metal)
- 1 Drafting room (classroom will do.)

Option No. 2.

- 1 General shop (containing four or more activities)
- 1 Unit shop (where vocational specialization is needed)
- 1 Drafting room.

3. *For schools containing 400 to 600 boys.*

Same as for smaller school with the addition of another unit shop (electric or other suitable for Smith-Hughes classes)

4. *For larger schools.*

- a. For schools of larger size one shop will be needed for each 200 additional boys or considerable fraction of this number.
- b. Vocational work which may be elected in the ninth grade will use one unit shop for each 40 boys.

F. *Minimum time for instruction.*

The minimum time that is profitable for industrial arts instruction is two hours a week. All boys in the seventh, eighth and ninth schools years should have at least that amount of instruction divided between shop work and mechanical drawing. By referring to the program of studies for junior high schools, it will be noted that electives are provided which make available additional shop work for boys who choose extra units in industrial arts.

## VI. MEANS AND METHODS USED IN PRESENTING INDUSTRIAL ARTS INSTRUCTION

- A. *Textbooks little used.* Industrial arts instruction does not lend itself readily to a formal textbook treatment. It is generally agreed among those in charge of this work that flexibility must be here maintained to a greater extent than in the more formal school subjects. Because of this belief, few schools have tied themselves down to courses that are too formal and detailed to admit of timely projects.
- B. *Limitation to standardization.* In districts where a number of shop centers are maintained, there are administrative difficulties that can be obviated only by the employment of a degree of standardization in problems, supplies and equipment. Such standardization, however, can be justified only up to a certain point since it is frequently found that two groups of

pupils in the same school district differ, due to their peculiar backgrounds. A school in one part of the city may for example draw pupils from a native residential neighborhood while another school may get its pupils from a cosmopolitan neighborhood, the group interests of which are consequently different from those of the first group. It would seem unwise to standardize the same problems for both throughout a course of industrial arts instruction for the grades under consideration.

- C. *The exercise method.* Conspicuous examples of a more or less formalized course of shop training have revealed themselves in the use of the exercise as a unit of instruction, particularly in wood shops. The abstract exercise was prominent in shop courses a decade ago but in the more modern pedagogical thought it stands for the most part discredited, while corresponding emphasis is placed upon the making of usable articles significant to society.

The exercise method of teaching industrial arts shop work presupposes that skill in handling tools is to be considered as an end in itself rather than as a means to an end, and exercises have usually been planned to economize time in teaching a variety of tool processes. There is a tendency at the present time to discourage the exercise idea in favor of a more vital treatment.

- D. *Individual problem method.* Industrial arts shop work is best taught by the use of the individual problem as a medium of instruction. The true project is admirable in this connection. Frequently pupils have projects upon which they are working outside of school. The teacher should endeavor to give recognition in school for any such worthy accomplishments. In some cases certain boys will be found who are able because of their special knowledge of wireless sets, for example, to assist the teacher in handling any instruction in that particular work.

- E. *Approximate number of pupils to a teacher.* Where classes are large and the periods short, the individual problem method makes unusual demands upon the instructor. In general this fact alone suggests an approximate maximum enrollment per week for one teacher. Twenty boys are as many as one teacher can successfully instruct at one time, although schedule difficulties may make necessary the including of a larger group. Half a day each week is a reasonable average time



to be devoted to this work. Thus it will be seen that two hundred pupils a week would be a sufficient number of pupils for one instructor.

- F. *Productive work.* School shops are turning more and more toward the production of articles of commercial value for use in the schools. These are often made in quantity. This practice is frequently referred to as "doing productive work."
- G. *Materials and methods of handling.* Materials are now so expensive that the cost contingent upon operating school shops has become a problem in the prosecution of the work. Various plans are in operation to control costs. Among these the two most common are (1) the plan whereby pupils pay for materials used in the construction of articles which become their personal property, and (2) the plan whereby pupils manufacture articles, needed by the schools, on a productive work basis. The educational contribution of each is different. In making an individual article for personal use the motive is not the same as that attached to factory production work. The latter develops team work and furnishes training in cooperation, whereas the former, while richer in its range of technique, has a more self-centered objective. Both should be represented in school shop work, but where factory production methods are used, caution is necessary to prevent too much repetition after the main instructional content has been exhausted.
- H. *Related instruction.* Shop work should be accompanied by a certain amount of information concerning processes and materials, their distribution and economic aspects.\* This work can be handled to a considerable extent by the regular classroom instructors in the school. It is recommended that all classroom teachers be encouraged to come into the shops and get first-hand material for correlation with classroom subjects. Supplementing this, the shop instructor will do considerable related teaching in the shop. This work should be carefully planned in order that too much time may not be taken away from actual manipulative work, especially in cases where but a short time each week is available for such shop work.
- I. *Instructional devices.* Devices which may be used effectively by the teacher of industrial arts may be noted by referring to "Individual Assignment Sheets" on pages 35-40 and to "Supplementary Lesson Sheets" on pages 28-29.

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\*See second notation under "Vocational Guidance Through Industrial Arts Instruction," page 18.

1. The "Individual Assignment Sheet" may be profitably used as follows:

The situation—A class of 20 boys in the general shop. Five boys each are assigned to wood work, sheet metal, machine work and electric wiring. The class is just beginning to take this work. The teacher finds it necessary to start the entire 20 boys at the same time.

- a. He has provided himself in advance with five or six different "Individual Assignment Sheets" for each activity.
  - b. Each boy is given a sheet showing the article or problem assigned to him.
  - c. Each boy, as he proceeds, keeps his assignment sheet and has it available to refer to his teachers in English, geography, mathematics, and any other subjects presenting opportunities for correlation.
2. Excellent material for short class recitations in the shop may be provided by means of "Supplementary Lesson Sheets" as shown on pages 28-29.
    - a. The teacher provides himself with mimeographed lesson sheets containing related information which ordinarily might have been imparted by the lecture method.
    - b. A lesson sheet on shellac, varnish or any timely subject can be given to the pupil for outside study between class-meetings. When he comes to class again, the teacher can, in a very short time, clinch the subject and thereby conserve class time for the manipulative side of the instruction.
    - c. If desired, each sheet can be clipped into individual notebooks or may be copied by the boys as a required outside assignment.
    - d. Written work based on industrial arts may be done in connection with shop notebook work. It should, however, ordinarily be handled by the teacher of English as an important means of correlation.
  3. Descriptive material may be posted upon the walls adjacent to each unit of equipment. This information should be organized in a very clear manner and should contain drawings, photographs, exhibits, blueprints, and descriptive booklets. In addition to this it is desirable to have a set of handbooks or encyclopedias in the shop for

ready reference. These may all be used to aid investigation on the part of pupils as part of the work in industrial arts.

- J. *Records.* Some form of records and progress charts should be used in connection with classes in shop work. These are frequently worked out by the individual teacher. Records should be kept of a pupil's progress through the various phases of the course. In a General Shop where individual members of the class are assigned to use the several units of equipment, there is no definite way to insure a proper balance of instruction in these different types of work except by progress charts or cards for the different pupils.

## VII. VOCATIONAL GUIDANCE THROUGH INDUSTRIAL ARTS INSTRUCTION

Industrial arts education may contribute to vocational guidance in four ways:

1. Through the content of the course by a variety of shop activities such as is easily possible in a general shop.
2. Through brief shop discussions, time can be conserved by the use of lesson leaflets, as preparation for such discussions. These should be prepared by the teacher.
3. Through personal conferences between the teacher and his boys. In every industrial arts shop the teacher should be in a favorable position to perform this service especially with reference to the status of employment in the different industries. He can in many ways assist in any organized guidance in the school.
4. Through visits by the class to industrial establishments.

## VIII. SUGGESTED UNITS OF EQUIPMENT FOR GENERAL SHOP

- A. *Variety of work provided.* The equipment of a general shop should represent in its appointments a wide range of activities. So far as is feasible these activities should reflect the industrial life of the community. In an average situation a group of four to six selected from among electric wiring, wood work on bench and lathe, sheet metal work, cement work, automobile repair, elementary machine shop work on bench and lathe, and printing might easily meet this condition. Where significant activities desirable for study may not



be included in the equipment, an effort should be made to consider them in class visits and through auxiliary instruction.

- B. *Units of equipment may vary as to extent.* Shop activities may be offered as early as the sixth grade and should be begun not later than the seventh grade. The units of equipment may vary as to extent and no attempt is here made to prescribe fixed limits. A typical make-up of units is indicated in this bulletin but it is assumed that no community will install any form of shop work without a careful analysis of local industrial needs. No particular make of tools and equipment is here recommended. There are a number of firms which make these of an acceptable quality and suitability.

There are certain occupations that do not readily lend themselves to treatment in the schools. On the other hand certain other trades will be reflected in any given general shop. The industrial nature of the community will, therefore, affect only certain variables that may or may not be included in the different situations. For example, a school placed in a community where the building trades predominate, would naturally include work in concrete.

- C. *Differences due mainly to amount of machinery used.* It will be readily appreciated that the units of equipment here listed must by the very nature of the case be merely suggestive, in view of the fact that some districts will not be able to equip shops as completely as others. Since the principal cost lies in the purchase of machines, it is probable that the main differences in such shops will occur in the amount and kind of machinery included in an equipment. In some instances it has been possible to secure pieces of old machinery or other material to help in equipping a school shop. Frequently business men are willing thus to assist the schools.

In selecting equipment it should be noted that the use of power-driven machinery is somewhat dependent upon the availability of electric current, although other power is not entirely impracticable.

- D. *Services of the Department of Public Instruction in planning equipments.* It is recommended that districts make use of the services of the Department of Public Instruction, Bureau of Vocational Education, in planning equipments rather than to rely upon any standardized list. The Bureau will take up each situation separately in view of the fact that local needs are not exactly alike in all districts.

- E. *Placing equipment.* When a decision has been made as to the extent of equipment to be placed in a room, it is well to have a scale drawing made of the floor plan.\* Then in order that the equipment may be placed to the best advantage, the following procedure may be observed:

Determine the size of the benches, machines, and floor equipment. Draw these to scale in the form of small rectangles upon thin cardboard. Cut them out and place them around on the floor plan, securing them into place on the drawing board by means of ordinary pins. A number of combinations can be tried and when the final arrangement has been made, the equipment will then be placed to the best advantage.

In providing for a forge it is important to see that it is placed with reference to chimney flues.

- F. *Maximum for room of usual size.* The equipment hereafter listed provides for eight typical activities. It is improbable that any one shop would be large enough to include all of these. Five type units would be the maximum for a shop of about 27 by 40 feet. The usual arrangement in a standard-size school room of 24 by 32 feet would include four activities.

- G. *Selection for the smaller schools.* The smaller schools in most cases have rather definite limitations as to room and equipment. Therefore, while a large variety of shop units may seem desirable from an educational standpoint it is probable that a selection of about four will be eventually made. The activities chosen will naturally be those which best fit the situation when all factors are considered.

- H. *Three-year schedule for equipment.* To expedite the early installation of an industrial arts shop in a small school having limited resources, it is often advisable to start with a partial equipment and then make additions annually over a period of three years. Such initial equipment would naturally be reduced to the bare minimum essentials. A schedule showing minimum lists for the various shops, including annual additions, is here given. No attempt is made, however, to indicate any particular group of activities which might be considered as forming a standardized shop for general application.

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\*See Appendix for suggestive floor plans.

# EQUIPMENT FOR A GENERAL SHOP WOOD WORK UNIT (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Single benches with vise (1 long bench optional) -----	5		
Jack plane, iron bottom -----	5		
Smooth plane -----		1	
Block plane -----	2		
Spoke shave -----	2		
Claw hammer, adze eye, 12 oz. -----	5		
Tee bevel -----		1	
Try square -----	5		
Marking gauge -----	2	2	
Ratchet brace, 16" swing -----		1	
Barber's brace, 10" swing -----	1		
Automatic push drill -----	1		
Steel square -----	1		
Rip saw, 5 pt. 26" -----	2		
Cross cut saw, 10 pt. 26" -----	1		
Cross cut saw, 10 pt. 24" -----	1		
Cupped nail sets assorted -----	3		
Firmer socket chisels 4" - 6" -----	2	2	1
Firmer socket chisels 1" - 6" -----	2	2	1
Firmer socket chisels 1" - 6" -----	2	2	1
Auger bits, sizes #4 to #16 -----	1		
Twist drills, Nos. 2, 3, 5, 7, 8 -----	2ea.		
Countersink -----	1		
Oil stone, combination faced -----	1		
Bench grinder -----	1		
Glue pot -----	1		
Copperized oiler, straight spout -----	1		
Malleable iron clamps, 6" -----	6		
Steel bar clamps, 36" -----	4	2	
Universal bench saw or band saw -----		1	
Bench jointer 6" -----			
Rules, Boxwood, brass tipped -----	5		

## ELECTRIC WORK (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Wiring booths to accommodate wiring boards, size 36" x 48" -----	5		
Flat nose pliers 6" -----	5		
Screw drivers 4" -----	5		
Door bells -----	12		
Buzzers -----	4		
Annunciator -----	1		
Bell Wire (feet of) -----	500	X	X
Pkg. insulated staples -----	2		
Dry cells -----	6		
Auto bulbs, 6 Volt & 3 Volt -----	2each		
Receptacles (to fit auto bulbs) -----	6		
Christmas tree lighting outfit -----		1	
Bell ringing transformer -----	1		
Toy motor (D. C.) -----	1		
Automobile horn (electric) -----	1		
Model of an electric meter (This can be made in the shop during the first year) -----		1	
Wireless outfit -----		1	
Receptacles, knobs, cleats, tape, switches, bulbs, etc. -----	X	X	X
Small motor generator set -----			1
Storage battery -----			1

## SHEET METAL WORK (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Hand punch .....	1		
Sheet iron folder .....	1		
Turning machine .....	1		
Forming machine .....	1		
Circumference rule .....	1		
Hollow mandrel stake .....	1		
Square stake .....	1		
Blowhorn stake .....	1		
Elbow edging or burring rolls for turning machine .....	1pr.		
Straight snips .....	2		
Circular snips .....	1		
Setting hammer .....	1		
Hand groover .....	1		
Cutting nippers .....	1pr.		
Ring scratch awl .....	3		
Solid punches .....	1set		
Rivet set .....	1		
Mallet .....	3		
Fr. Dividers 8" .....	1		
Soldering coppers, 2 lb. ....	2		
Handles for soldering coppers .....	2		
Plumber's scraper .....	1		
Double burner gas furnace .....	1		
Stone soldering slab $\frac{3}{4}$ " x 14" x 14" .....		1	
Acid cup .....	1		
Acid swab .....	1		
Jar for dipping solution .....		1	
Reading machine .....		1	
Additional tools and equipment suited to any special product made in the shop .....			X

## MECHANICAL DRAWING (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Drafting boards 18" x 24" .....	5		
Tee squares, 24" blade .....	5		
Celluloid triangles, 60°-30°, 8" .....	5		
Celluloid triangles, 45°, 6" .....	5		
Compasses with pen attachment .....	5		
Ruling pens .....	5		
Individual drafting tables (or 1 long table) .....	5		
Box thumb tacks .....	1		
Pkg. buff detail paper 11" x 15" .....	2		
Blue print frame .....		1	
Blue print paper, 5 yd. roll .....		1	
Box pens .....		5	
Drawing board 20" x 30" .....		1	
Tracing paper (yds.) .....		5	
Tee square 30" blade .....		1	
Bottles black waterproof ink .....		5	
Demonstration set of drawing instruments for instructor's use .....			1
Tracing paper (yds.) .....			5

## ELEMENTARY MACHINE WORK (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Long bench fitted with -----	1		
2 stationary machinist's vise -----			
1 swivel machinist's vise -----			
1 blacksmith's vise, 4" -----			
Hack saw frame with 6 blades -----	2		
Assorted files -----	12		
Ball peen hammers 12 oz. -----	5		
Cold chisels, $\frac{3}{4}$ " -----	3		
Cold chisels, $\frac{5}{16}$ " -----	3		
Cold chisels, 1" -----	3		
Sensitive drill press -----	1		
Machinist's scale, 6" -----	2		
Combination square, 12" -----	1		
Heat treatment furnace (or forge optional) -----		1	
Anvil -----		1	
Bench lathe with essential tools and attachments -----	1		
Grinder -----			1

## CONCRETE WORK (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Spading tools -----	2		
Edger -----	1		
Groover -----	1		
Steel finishing trowels -----	2		
Cement worker's trowel -----	1		
Pointing trowel, 4" -----	1		
Wooden float (made in shop) -----	1		
Small bins for storing sand and cement -----	3		
Water tub for curing small pieces -----	1		
Measuring box, size $\frac{1}{4}$ cu. ft. -----	1		
Measuring box, size $\frac{1}{2}$ cu. ft. -----	1		
Measuring box, size 1 cu. ft. -----	1		
Supply of wire and rods for reinforcing -----	X		
Raw iron oxide (lbs.) -----	5		
Carbon black (lbs.) -----	5		
Cement (sack) -----	2		
Flower box forms (made in shop) -----		X	
Sand (cu. ft.) -----	5		
Urn forms (made in shop) -----		X	
Forms for advanced projects (made in shop) -----			X



## AUTOMOBILE REPAIR (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Engine (out of an old car) -----	1	-----	-----
Set of socket wrenches -----	1	-----	-----
Set of solid fork wrenches -----	2	-----	-----
Stillson wrench, 10" -----	1	-----	-----
Monkey wrench, 8" -----	1	-----	-----
Set taps and dies (A. L. A. M.) -----	1	-----	-----
Tube vulcanizer and materials -----	1	-----	-----
Breast drill -----	1	-----	-----
Bearing scraper -----	1	-----	-----
Portable lamp and cord -----	1	-----	-----
Valve lifter -----	1	-----	-----
Valve grinding compound (box) -----	1	-----	-----
Chassis -----	-----	1	-----
Auto parts such as extra transmission, rear axle assemblies, starting motors, etc. -----	-----	-----	X

## PRINTING WORK (5 BOYS)

	Number of pieces to be ordered.		
	1st yr.	2nd yr.	3rd yr.
Imposing table, coffin and marble surface, 24" x 36" -----	1	-----	-----
Font labor saving wood furniture with case -----	1	-----	-----
Font galleys with case -----	1	-----	-----
Benzine can -----	1	-----	-----
Benzine brush -----	1	-----	-----
Steel roller bearers (pr.) -----	2	-----	-----
Gauge pins -----	12	-----	-----
Rule case -----	1	-----	-----
Case racks -----	2	-----	-----
California job cases -----	12	6	-----
Lead and slug case -----	1	-----	-----
Printing press, 8" x 12" -----	1	-----	-----
#2 quoins -----	12	-----	-----
Quoin key -----	1	-----	-----
6" brayer -----	1	-----	-----
Star sticks, 2" x 6" (gauged) -----	5	-----	-----
Star sticks, 2" x 8" (gauged) -----	1	-----	-----
Steel galley, 6" x 10" -----	1	-----	-----
Steel galley, 3" x 24" -----	2	-----	-----
Waste can -----	1	-----	-----
Font 10 pt. Century Old style -----	2	-----	-----
Font 24 pt. Century Old style -----	2	-----	-----
Font 36 pt. Century Old style -----	1	-----	-----
Font 18 pt. Century Old style Bold -----	1	-----	-----
Font 24 pt. Century Old style Bold -----	1	-----	-----
Font 48 pt. Century Old style Bold -----	1	-----	-----
Font 6 pt. copper plate Gothic Heavy #24 -----	1	-----	-----
Font 12 pt. copper plate Gothic Heavy #26 -----	1	-----	-----
25 lbs. each 6 and 12 pt. leads and slugs 4 to 24 picas -----	50	-----	-----
1 lb. font 2 pt. brass rule -----	1	-----	-----
Semi-steel chase 8" x 12" -----	3	-----	-----
16" paper cutter -----	-----	1	-----
Additional type and equipment depending upon the work attempted -----	-----	-----	X
Font 10 pt. Century Old style Italic -----	-----	1	-----
Font 12 pt. Century Old style Italic -----	-----	1	-----
Font 18 pt. Century Old style Italic -----	-----	1	-----
Font 24 pt. Century Old style Italic -----	-----	1	-----
Font 36 pt. Century Old style Italic -----	-----	1	-----

## IX. SCOPE OF SHOP PROBLEMS

- A. *Pupil Interests Determine Problems.* In general, the interests of the pupils should determine the problems to be presented. Projects which arise in the lives of the pupils may be woven into any course in the general shop. The teacher will have a number of set problems ready to present, but these will ordinarily be prepared for use in the absence of individual or class projects which present themselves from time to time. For example, the construction of some scenery frames for a class entertainment might well be substituted for some of the set problems in woodworking and meet even more fully the aims of industrial arts instruction.
- B. *Wood Shop Problems.* Wood shop problems may be considered from two angles: the industrial arts work which is given in a special wood shop, and the wood work that is included in the activities of a general shop.
1. Problems for the shop devoted to wood alone,\* should be planned in such a way as to attain the aims of industrial arts instruction—first, through making articles for the pupil's individual ownership; second, through production of things needed by the schools or civic bodies; third, through a carefully selected list of problems which the teacher arbitrarily plans out in advance.
  2. In the general shop, the scope of wood work is reduced in point of time, as compared to the single purpose wood shop. This must usually be the case, since the general shop contains four or five types of work, each of which is given equal time with the other activities within the shop.
- C. *General Shop Problems.* The problems undertaken in a general shop will often be made of several materials. The making of a toy motor is primarily electric work but it may have a wooden part, such as the base or mounting, and the construction of it would entail the use of machine shop and sheet metal equipment. In this respect many of the wood problems for such a shop may differ from the ones found in a shop devoted entirely to wood.
- D. *Sheet Metal Shop Problems.* The sheet metal work that may be done in a general shop consists in a range of problems that bring out the use of typical sheet metal equipment. A

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\*Manual Training (industrial arts the preferred term).



variety of cookie cutters are often made at the outset of the course. Cups, funnels and parts of such things as water motors are found to be useful problems. In many schools useful things are readily made from tin cans.

- E. *Electric Shop Problems.* Electric wiring and construction, given in a general shop, may include a variety of bell wiring problems, followed by experimental work on small motors, transformers and auto ignition.
- F. *Elementary Machine Shop Problems.* Elementary machine work takes up problems in chipping, filing, cold-bending and work in boring, tapping and die work. Such problems as a bolt and nut, nail set, ice pick, center punch and parts of articles made in more than one material are suitable for bench work. Plain turning on the bench lathe may be varied and may contribute to problems entailing more than one material.
- G. *Automobile Shop Problems.* In schools having an automobile unit in the general shop, a number of interesting problems can be developed in taking apart and reassembling, testing, tire repairing, relining brake bands, ignition work, and a variety of such typical operations in repairing an automobile.
- H. *Problems in Concrete.* Cement work is highly adaptable to school shop instruction. Many small vases, urns, flower boxes, and the like can be made in a general shop. The forms for molding the articles mentioned make excellent problems in wood. Rods for reinforcing are good cold-bending problems in metal work.
- I. *Print Shop Problems.* Problems in printing can be made to contribute to many phases of school activities. Placards, programs, and tickets readily provide work for the pupils assigned to this unit of the general shop. In the seventh grade, it is probable that work in large type will be found advisable.
- J. *Mechanical Drawing Problems.* A mechanical drawing should in most cases precede the construction of an article in the shop. In the making of such drawings, care should be exercised to conform to the accepted rules for use of the tee square and triangles. While drawing may in this way be incidental to each shop problem, it may also be used to form a separate unit in a general shop.

## X. MAKING THE COURSE OF STUDY

- A. *Basis of Course Planning.* A course of shop problems in the general shop should be based upon—first, the life interest of a pupil group; second, the essential characteristics of the several occupations represented; third, the fullest use of the equipment available.
- B. *Course Should be Flexible.* Since life interests differ with pupils, it is necessary to make industrial arts instruction flexible and to have it in a state of continuous evolution. It is necessary and proper, however, to make an outline plan for each term, and not leave everything to inspiration and the chance that a teacher will make a timely discovery of the exact needs of every pupil.
- C. *Core of Instruction.* Participation in and information about any trade or occupation may be used as the core for course construction. It may happen that only one phase of a trade will be found in the vicinity of a school. This phase should usually have more emphasis in a course which is planned for the pupils of such a school.
- D. *Problems Meet Equipment Limitations.* The amount and kind of equipment vary in different schools, and while this is usually a matter that may be easily controlled, it is well to think of problems for a course in terms of the tools and machines to which pupils have access both inside and outside of school.
- E. *Need of Planning.* Successful work in industrial arts depends largely upon the teacher. Because of the individual nature of general shop instruction there is need for planning, previous to class time, of a number of suitable problems that can be given to pupils on Individual Assignment Sheets. The danger of formalizing the instruction is remote since the number of problems thus worked out would at no time include the entire class activities. It is certain that no teacher can do effective work without detailed planning before the class comes into the shop. It is suggested that the teacher work out his outline for the duration of the course, giving number of weeks; shop work; related instruction in the shop; classroom correlation; and class visits according to the form suggested in this bulletin.
- F. *A Further Aid to Instruction.* A further aid to instruction will be found in the use of Individual Assignment Sheets

which may be mimeographed. The purpose of these is twofold: first, they give the individual pupil a drawing to guide his construction; second, they note the correlation of the shop work with regular classroom activities.

- G. *Home Repairs, a Project in Course Planning.* An interesting project in course planning may be worked out on the basis of a survey of jobs around the home which the average man is called upon to do from time to time. A list of minor repairs to the house, plumbing, wiring, heating plants, furniture, garden equipment and the like may be compiled as a basis for problems which may be used for industrial arts shop instruction. This work is readily handled with a general shop equipment. It may be given profitably in the early periods of a junior high school course.

### ELECTRICAL WORK

No. of weeks	Shop Work	Related Instruction in the shop	Classroom Correlation	Class Visits
	Bell wiring	Insulation Wire covering Staples	Story of Edison Franklin and the lightning rod	Local supply house or
	Door bell with one button	Dry Cell Life and Care	Manufacture of wire and its use in the world	Inspection of bell system on elevator or in hotel
	Door bell with two buttons			

(Course to be worked out by the teacher)

### ELEMENTARY MACHINE WORK

No. of weeks	Shop Work	Related Instruction in the shop	Classroom Correlation	Class Visits
	Angle iron Drilling and Counter-sinking screwholes	Use of angle irons in construction Files and their use.	Stone age and the gradual introduction of metals File manufacturing	A machine shop

(Course to be worked out by the teacher)

## SHEET METAL

No. of weeks	Shop Work	Related Instruction in the shop	Classroom Correlation	Class Visits
	Cookie cutter Scoop made from tin can	Solder Of what made Melting point	Story of tin plating Tin can industry	Local tin shops or plants making utensils. Local canning factory

(Course to be worked out by the teacher)

## CONCRETE WORK

No. of weeks	Shop Work	Related Instruction in the shop	Classroom Correlation	Class Visits
	Concrete building brick  Vase	Sizes and use of bricks. Adaptability for chimneys.  Rules for making wooden forms.	Story of cement. Ancient use of concrete. Use of pamphlets mentioned in bibliography.	Buildings in process of erection. Concrete block plant. Sidewalk laying Street paving.

(Course to be worked out by the teacher)

## XI. QUALIFICATIONS OF INDUSTRIAL ARTS TEACHERS AND THEIR CERTIFICATION

It is highly important that well-trained teachers be selected for the teaching of industrial arts work. It is a fallacy to expect good shop instruction from teachers who, while professionally trained, have little direct knowledge of the practices and problems of industrial employments. Similarly it should not be expected that a person who has mastered a skilled trade can by virtue of his specific knowledge immediately become a skilled teacher. Unusual demands upon teachers of industrial arts require particular preparation. The general shop especially demands a teacher of high native ability, adaptability, and training if results are to be expected.

Only a teacher trained in methods and the other subjects peculiar to the efficient imparting of instruction can be expected to study out and formulate classroom correlations and thought—provoking related shop instruction.

The preparation necessary to secure a certificate to teach industrial arts work in the public schools of the Commonwealth of Penn-

sylvania is noted in the following qualifications as set up by the Teacher Bureau, Department of Public Instruction:

#### A. Regulations Governing Certificates Previously Issued

1. All Temporary Special, Normal and Provisional College Certificates now valid will be renewed and made permanent in accordance with the conditions upon which they were issued.
2. Permanent certificates to teach industrial arts are not affected by the following regulations. These regulations govern the issue of new certificates.

#### B. Minimum Requirements

For all certificates herein listed there will be required in addition to those requirements set forth below (1) graduation from a four year high school or equivalent education; (2) satisfactory contact with the vocation.

##### 1. Partial Secondary

- a. Issued for one year upon evidence of two years of technical training beyond high school. Approved vocational experience may be offered as the equivalent of the education and training required for this certificate.
- b. This certificate is issued only upon the request of the Superintendent desiring to employ the candidate and is valid only in the county or district for which issued.
- c. It is renewable the first time on a rating of "low" or better plus six semester hours of approved training and subsequently renewable on a rating of "middle" or better plus six additional semester hours of approved training.

##### 2. Standard

1. *Temporary*—Issued for two years upon graduation from a two year (70 semester hours, 72 weeks) approved teacher training curriculum in industrial arts education. Observation, participation and practice teaching of not less than 6 semester hours or its equivalent must form part of this requirement. It is renewable once on a rating of "low."



In evaluating credentials toward standard certification where the applicant has not been graduated from an approved course in the specified field but presents seventy semester hours of approved training as an equivalent thereof, the following distribution will be made:

Academic credit	20 semester hours
Professional credit	20 semester hours
Technical credit	20 semester hours
Unassigned credit	10 semester hours -

Approved industrial arts experience may be offered to meet the technical requirement for this certificate at the rate of four semester hours per year and not to exceed a total of thirty semester hours.

An approved plan of intensive supervision will be accepted in such districts as are in a position to offer such a plan in satisfying the practice teaching requirement of the professional division of this assignment.

2. *Permanent*—Issued for life upon evidence of four years of experience in teaching industrial arts on a State certificate, at least two of which shall have been on a Temporary Standard Certificate with a rating of “middle” or better.

### 3. Normal

- a. *Certificate*—Issued for two years to normal school graduates.  
Renewable once on a rating of “low.”
- b. *Diploma*—Issued for life upon evidence of two years of experience in teaching industrial arts on a normal certificate with a rating of “middle” or better.

### 4. College

- a. *Provisional*—Issued for three years to graduates of approved four year teacher training curriculum in industrial arts education in accredited institutions. Renewable once on a rating of “low” plus six semester hours of graduate credit, one-half of which should be professional training.

- b. *Permanent*—Issued for life upon evidence of three years of experience in teaching industrial arts on a Provisional College Certificate with a rating of graduate credit, one-half of which should be professional training.

### C. Limitations and Privileges

1. Each certificate issued shall have written on its face those subjects which the holder is entitled to teach.
2. No industrial arts teacher shall teach any subject not appearing on his certificate.
3. A certificate to teach any subject on an industrial arts basis is valid for teaching that same subject in evening or continuation schools.
4. A general industrial certificate is valid for industrial arts work in the same subjects.
5. A certificate to teach any subject on a unit trade basis may be used for industrial arts instruction in the same subject, if the superintendent employing the candidate will request the Department of Public Instruction for the extension of the certificate to cover this work.

### D. Registration of Certificates

Section 1324, School Laws and Decisions of Pennsylvania.

"Before entering upon the work of teaching, every holder of a permanent, special or State certificate, of any kind, shall present it, for registration, to the proper superintendent, who shall record its kind, number, and date of issue, together with the branches which it covers. Whenever new branches are added to any certificate, these shall be added to the record upon presentation of said certificate to the superintendents."

All questions concerning certification should be addressed to the Teacher Bureau, Department of Public Instruction, Harrisburg. Proper blanks and all necessary information will be furnished upon application.



## APPENDIX

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### SPECIMEN SUPPLEMENTARY LESSON SHEETS

#### VARNISH

Varnish such as is used on furniture, floors, doors, automobiles and in many other places, is made largely from oils and rosins. The name "Copal" is used to denote most of the latter substances. They are in reality gums which exude from certain trees, and are obtained largely from Zanzibar, Madagascar, and Mozambique. The best of these rosins are dug out of the ground where time has petrified or fossilized them.

The manufacture of varnish is carried on in six stages:

- 1st. The rosin is melted (care must be used not to overheat).
- 2nd. The oil is boiled for one or two hours during which lead or manganese compounds are dissolved in it.
- 3rd. The oil and rosins are mixed while hot and stirred thoroughly.
- 4th. The mixture is now boiled. Later it is reboiled to make it clear and stringy.
- 5th. Turpentine or some other thinning material is added to reduce the viscosity of the liquid.
- 6th. The varnish is now allowed to clear and age. Finally the top or clarified liquid is poured off and is ready to use. Allowing the liquid to stand for a time improves it. This is called aging.

It is well to purchase a varnish which has been made to serve a definite purpose. Floor varnish must have certain qualities not demanded elsewhere. Likewise a finish for automobile and other articles exposed to the weather must be especially made to meet this severe condition. Fine furniture requires a rubbing varnish, which dries hard and is somewhat brittle. Finishers apply this material by means of bristle brushes, air brushes (fine spray) and by dipping.

#### SHELLAC

The hard glossy finish that is known as shellac has many uses and comes from an interesting source.

A small insect found in northeastern India called the coccus lacca pricks the tender bark on the twigs of the fig tree, and as the sap oozes out this insect exudes a material which, combining with the sap, forms into a hard crust. Millions of these insects lay eggs in this sticky mass and eventually die in it. As it accumulates and hardens around the twigs it becomes the "stick lac" of commerce. The natives gather it and it then is ready to be refined.

When thrown into vats of water, a reddish-purple dye soaks out. (The word lake as applied to paint colors has its origin here.) The lac is then heated and collected in a melted state. It may then be spread out thin on stones and no doubt gets its name from its shell like appearance.

Lower grades of shellac are used as glue in the doll industry. It has many uses as a glue. When melted it becomes very sticky and if worked quickly, will be quite satisfactory as glue with the added advantages of being instantly dry or set upon cooling.

For a wood finish the dry shellac may be mixed with alcohol. It becomes spirit varnish in a short time and is much prized as a finish for wood patterns as well as first coat for copal varnish finishes. Care should be used to apply the coats thin and to brush them out well.

If orange shellac needs bleaching for a lighter hue, the addition of about a thimbleful of oxalic acid crystals to a quart of the liquid will improve the color. In this condition it is the favorite finish for Industrial Arts work. As shellac dries in a very few minutes, an article can be varnished and dry enough to put away by the end of a shop period, while ordinary varnish takes several hours and some grades several days to permit handling.

#### FIGURING AND CUTTING PAPER STOCK

In purchasing paper for the print shop it is well to keep in mind the units by which paper is sold. You have been taught that the legal quire is 24 sheets and that the ream consists of 480 sheets. However, in modern business where jobs are ordered by the thousand, the quire is usually 25 sheets and the ream 500 sheets.

When planning a job be sure that you calculate correctly the number of sheets that can be cut from the stock. It is economy to use a size of stock that will cut with the least waste. It is well to count on 2 per cent waste for each time the paper is to go through the press.

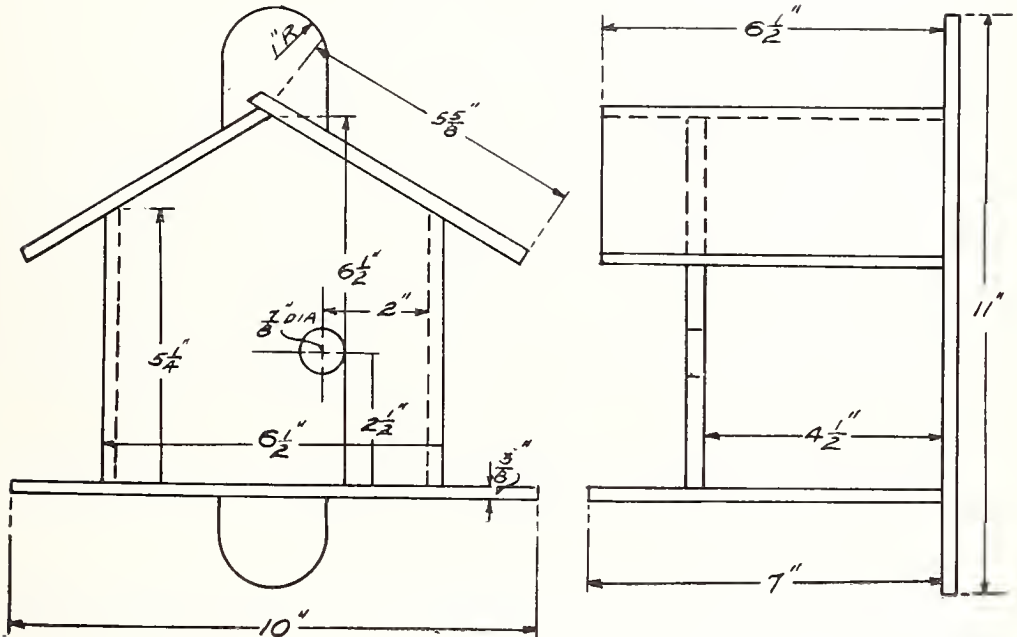
In cutting paper, proceed with caution. If you have planned to cut a certain number out of the sheet in one direction and a certain number at right angles, be sure that you do not take the first cut in the wrong direction or your calculations are likely to be entirely upset.

The average letterhead is  $8\frac{1}{2}$  by 11 inches. If you have 17" x 22" stock and wish to fill an order for 500 letterheads that can be printed in one impression, how many sheets of stock will be required?

If you have a supply of stock 28" x 34" out of which to cut  $8\frac{1}{2}$ " x 11" letterheads, could you get more out of each sheet if you planned so that the length of the letterhead would run with the length of the stock? How about disposal of the waste? In case you cut the paper at right angles to the way mentioned, how many sheets 6" x 8" could be cut out of each sheet of waste trimmings?

Many cover papers will fold only with the grain unless scored. If there is any choice in the matter, cut the stock so that it can be folded with the grain.

INDIVIDUAL ASSIGNMENT SHEET  
OF  
BIRD HOUSE



**Stock**

White pine or other soft wood  $\frac{3}{8}$ " S<sub>2</sub>S.

**Construction**

Nailed excepting the bottom, which is screwed on to permit cleaning.

**Nature Study**

The diameter of the entrance to House Wren nesting boxes should be  $\frac{7}{8}$ ", and the house should be placed six to ten feet above the ground. These precautions will keep out enemies of the birds.

**Mathematics**

How many feet of lumber will be contained in a wren house the inside measurements of which are  $5\frac{3}{4}$ " x  $4\frac{1}{4}$ " x  $6\frac{1}{2}$ ", as noted in the above sketch?

Additional information on sizes of bird houses is contained in Farmer's Bulletin, No. 609, U. S. Department of Agriculture.

**Drawing**

Sketch and make a simple working drawing of the above bird house. Redesign the house if you desire, using the inside dimensions 4" x 4" floor by 6" height. Rustic effects may be secured by the use of bark and twigs.

**Community Civics**

Birds destroy insects and thereby are benefits to mankind in protecting crops. Are there any bird house contests in this locality? Sometimes merchants conduct contests and give prizes for the best bird houses. As most of the houses in the contest are eventually mounted for the use of birds, the contest idea is very commendable.

**Reading**

Read about the work of the Audubon Society in protecting bird life. Read "How To Attract Birds in the Middle Atlantic States," Farmer's Bulletin, No. 844, U. S. Department of Agriculture.

**Geography**

Wrens are common to Pennsylvania. They arrive in the spring and migrate south when the cool September days come.

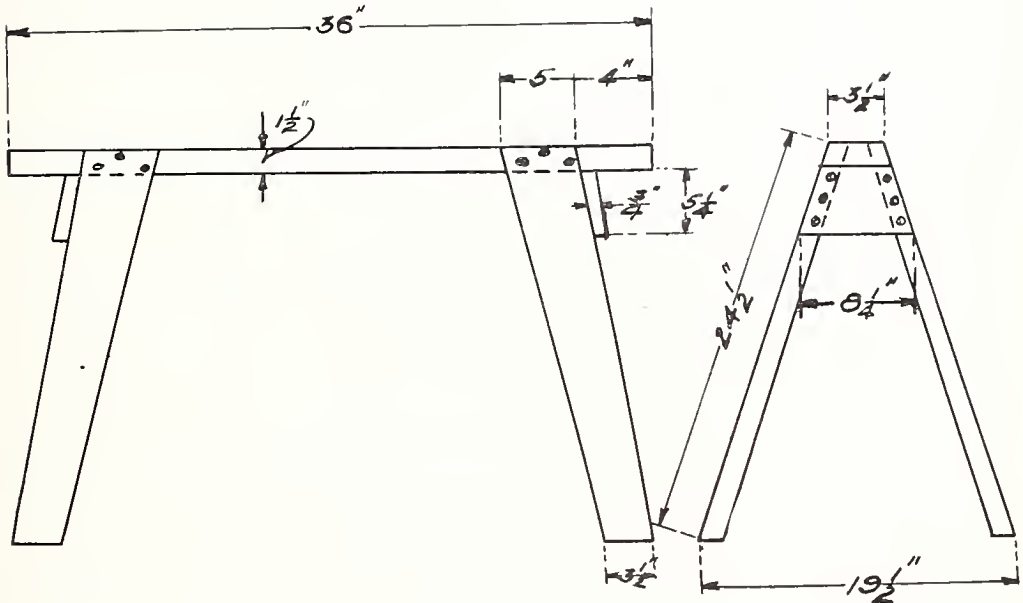
**Science**

Wood warps and swells when it becomes wet. Painting seals the surface pores of wood and prevents absorption of water. In painting the bird house use a lead and oil paint. As it is to be used out of doors very little drier need be used in the paint. What causes this to be true?

**Hygiene and Safety**

Use care in sawing thin wood. It is more likely to split and cause injury to the worker. If a power saw is used, be sure that the safety guard is in its place.

INDIVIDUAL ASSIGNMENT SHEET  
of  
A SAW HORSE



**Drawing:** Make a working sketch of the saw horse. Then draw to scale, using pencil, compasses, tee square and triangle.

**Stock:** Select hard or soft wood according to service required.

- 1 Saddle  $1\frac{1}{2}'' \times 3\frac{3}{4}'' \times 25''$  S<sub>2</sub> S.
- 4 Legs  $\frac{7}{8}'' \times 3\frac{3}{4}'' \times 25''$  S<sub>2</sub> S.
- 2 Braces  $\frac{7}{8}'' \times 5\frac{1}{2}'' \times 9''$  S<sub>2</sub> S.
- 24  $1\frac{1}{2}''$  No. 10 F. H. B. Screws.

**Construction:** Get out sufficient number of pieces to sizes noted in stock list. Clean up faces, gauge to size and plane. Make full-size detail of angles and set tee bevel. In assembling, drill and countersink screw holes.

**Safety First:** Any machines which you use must have safety guards in place. Avoid holding tools carelessly: they may cause you serious injury.



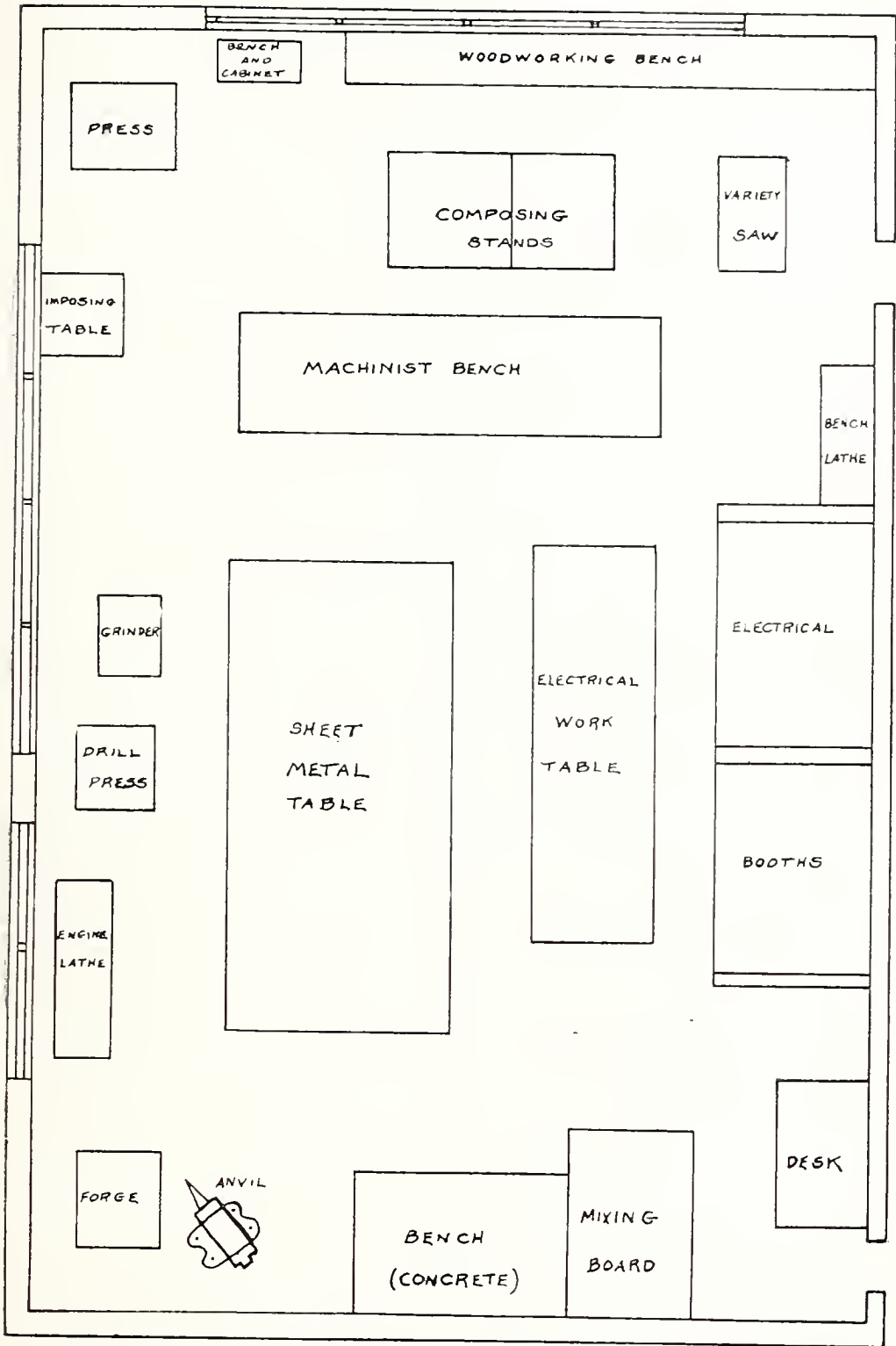
To the pupil:

This assignment sheet is your own personal property. Preserve it carefully. Show it to any of your teachers in other subjects who may wish to tie up lessons in arithmetic, reading, composition, geography, community civics or other subject with what you are doing in the shop.

To teachers of subjects noted above:

This boy is making a saw horse in his industrial arts work. As a problem it presents the following points for correlation in other studies:

- |                   |   |
|-------------------|---|
| Arithmetic:       | Calculate the number of board feet in stock bill and find cost of the wood at \$60 per M.   |
| Reading:          | Look up several references to house building. Clip such material from the daily paper or magazines.                                       |
| Composition:      | Use this reading as a basis for written work, together with an account of the building of the saw horse.                                  |
| Geography:        | Locations of forests in America and more particularly in this vicinity. What is hardwood? Why so called? What is forestry?                |
| Community Civics: | What part does home building have in our community life? Is it true that a community of ramshackle homes is likely to be poorly governed? |



Suggestive Sketch of Layout for an Industrial Arts General Shop

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